

Enhancing Teaching and Learning in Grade 9 Applied Mathematics: Summer Conference



An agenda can be found at
9appliedsummerinstitute.wikispaces.com
[#math4theNines](https://twitter.com/math4theNines)



Steering Committee

Year 1

- Kaye Appleby, Project Manager
- Sandy Dilena, MOE Education Officer
- Sonia Ellison, OAME Past-President
- Lynda Ferneyhough, OAME Executive Director
- Alison Macaulay, MOE Education Officer
- Chris Suurtamm, University of Ottawa
- Erik Teather, OMCA

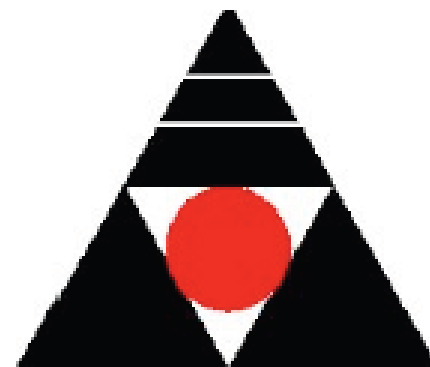
Year 2

- Kaye Appleby, Project Manager
- Connie Quadrini, Provincial Math Lead
- Agnes Grafton, Provincial Math Lead
- Lynda Ferneyhough, OAME Executive Director
- Alison Macaulay, MOE Education Officer
- Chris Suurtamm, University of Ottawa
- Dan Allen, OMCA



Permission forms

The Ontario Association for
Mathematics Education
4751 Mack Avenue
Plympton-Wyoming, ON N0N 1J8



Consent and Waiver Agreement

PRINT Your Name

Address with Postal Code

Thank you for agreeing to participate in the 2016 *OAME/OMCA Grade 9 Applied Math Summer Institute*.

If you agree with these terms and conditions, please sign and date the copy of this agreement and return it to the conference organizers.



OAME / OMCA Grade 9 Applied Project
TRAVEL AND EXPENSE claim form

Name:

Address:

Email:

Phone:

Date	Description (state address of leaving and arrival locations)	km	Travel (Air/taxi, etc.)	B L D	Meals (total \$)	Accommodation	Other (provide details)	Receipt number*

Travel costs:

Travel costs using “most economic available” or \$0.40/km and dinner maximum of \$20.00 will be reimbursed **if claims are received by OAME before September 30, 2016.**

Original receipts and google or mapquest mileage verification will be required.

Travel expenses

- Mileage (supported by google print-out) @ \$.40/km
- Original receipts (not credit card receipt) for flights, trains,... using “most economical”
- up to \$20 (no alcohol) for dinner

Copies of claim form and a stapler
available at registration desk during
lunch each day

Individual claims may be handed to
Kaye during lunch each day.

All personal or Board claims are to be
submitted **before September 30, 2016**

Background

Funding was provided to support several English-language school teams to work collaboratively to focus on enhancing their understanding of the Grade 9 Applied curriculum and in implementing the curriculum in ways that will best meet the needs of their students.

Goals of the overall project:

- increase teacher knowledge of the curriculum, both in terms of mathematics content knowledge and mathematics knowledge for teaching
- identify strategies for implementing effective teaching and learning;
- foster teacher leadership in mathematics.

Background

In June 2014, a call to all schools went out to apply to take part in this project. Close to 50 schools applied and 10 school teams were chosen.

It was planned that each school team would consist of:

- Administrator (Principal or Vice-Principal),
- Mathematics Department Head (and/or School Board Lead),
- 2 – 3 teachers of Grade 9 Applied Mathematics,
- Special Education Teacher,
- Student Success Teacher

The teams met monthly over the 2014-2015 and 2015-2016 academic year. Their initial meeting was centred on determining some aspect of their teaching and learning as a focus of their professional learning.

School Teams

- Year 1 started with 10 school teams across Ontario – from 9 different school boards and 9 schools continued into Year 2
- They represent
 - Urban, rural, suburban schools
 - Catholic and public school boards
 - Small schools and large schools
 - A range of student populations

Introduction of School Teams

School teams

- Beaver Brae SS, Keewatin-Patricia DSB
- Castlebrooke SS, Peel District School Board
- Eastview SS, Simcoe County DSB
- St. John Catholic HS, Catholic District School Board of Eastern Ontario
- St. Joseph Catholic HS, Windsor-Essex CDSB
- St. Joseph-Scollard Hall CSS, Nipissing Parry Sound CDSB
- Glebe Collegiate, Ottawa Carleton District School Board
- Listowel District SS, Avon-Maitland DSB
- St. Thomas of Villanova CHS, Windsor-Essex CDSB

Components of the Project

- Collaborative Inquiry: Professional Learning and Practice
- Research Component
 - To support teams with resources, research, ideas they feel they need
 - To provide descriptions of the team's processes, investigations, goals, activities, and outcomes of their work, etc.

By combining the work of all of the school teams, we can describe various ways that teams work on improving teaching and learning in Grade 9 Applied classes with a view to see how this work may support and provide advice to others in the province.

Research Team

- Principal Investigator:
 - Dr. Christine Suurtamm,
University of Ottawa (Lead)
- Research collaborators:
 - Dr. Martha Koch,
University of Manitoba
 - Dr. Timothy Sibbald,
Nipissing University (Year 1)
- Research Project Manager
 - Brenna Quigley,
University of Ottawa
- Research Assistants
 - Alison Goss (Year 1)
 - Kelsey Knowles
 - Ina Lazarescu (Year 2)
 - Jill Lazarus
 - Kelly McKie
 - Ellen Morrison (Year 2)
 - Jimmy Pai

Over the next 2 days:

You will hear from researchers, steering committee members and most importantly, the school teams themselves to hear about and engage in:

- The ideas and practices that school teams took into their classroom,
- Ways in which they worked as a PLC that were most productive
- Challenges they met and how they were overcome
- Research that helped to shape their work and research that reports on their work
- Ways to start your own journey

Day 1

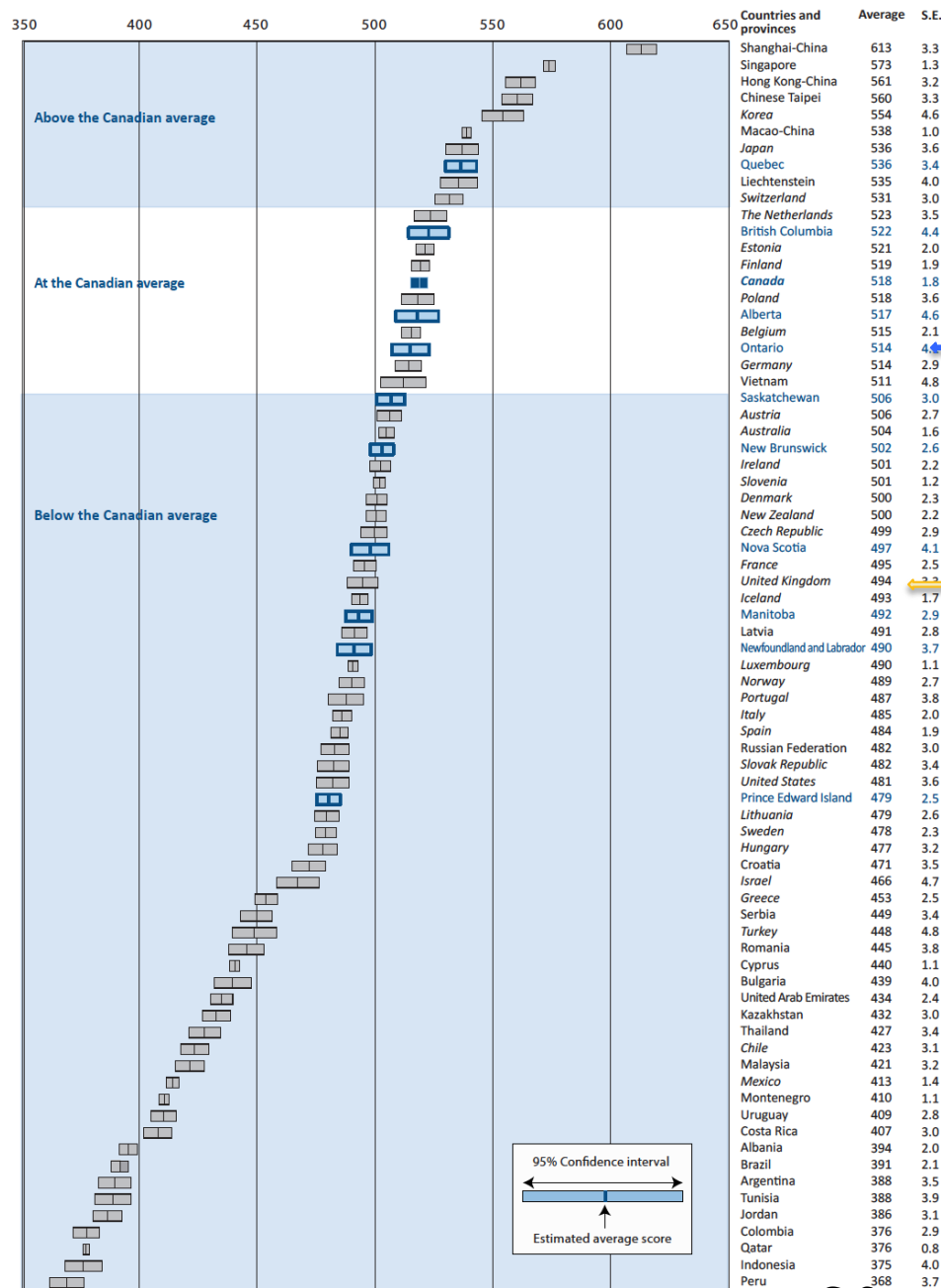
Time	Activity	Location	Facilitator/Presenter
9:00 – 9:30	Welcome and Introductions	Plenary Room	Steering Committee
9:30 – 10:15	Overview and Focus of the Project	Plenary Room	Dr. Chris Suurtamm
10:15 – 10:30	Break		
10:30 – 11:50	Snapshot work of school teams in project	Break out Rooms	School teams
11:50 – 1:00	Participant school team sharing and planning	Plenary Room	
	Lunch		
1:00 – 1:30	Overview of effective classroom practices	Plenary Room	Dr. Chris Suurtamm
1:30 – 2:45	Workshops on variety of classroom practices	Break out rooms	School teams
2:45 – 3:00	Break		
3:00 – 3:15	Conference participants sharing and planning	Plenary Room	Dr. Chris Suurtamm
3:15 – 4:00	What does the research show about Grade 9 Applied mathematics?	Plenary Room	Dr. Alison Macaulay

Day 2			
Time	Activity	Location	Facilitator/Presenter
9:00 – 9:30	Effective ways to engage in professional learning as a team	Plenary Room	Dr. Chris Suurtamm
9:30– 10:15	Panel discussions on the ways that teams worked	Break out rooms	School teams
10:15 – 10:30	Break		
10:30 – 11:00	Conference participants sharing and planning	Plenary Room	Dr. Chris Suurtamm
11:00 - 12:00	Plenary: Five practices presentation	Plenary Room	Dr. Martha Koch
12:00 – 1:00	Lunch		
1:00 – 2:15	Workshops on variety of classroom practices	Breakout rooms	School teams
2:15 – 2:30	Break		
2:30– 2:45	Conference participants sharing and planning		Dr. Chris Suurtamm
2:45 – 4:00	Where do we go from here? Facilitated next steps	Plenary Room	Dr. Chris Suurtamm Kaye Appleby

MEASURING UP!

2 slides from Pasi Sahlberg were here

See his slides from ICSEI 2016 <http://pasisahlberg.com/wp-content/uploads/2013/07/ICSEI-2016.pdf>



Note: OECD countries appear in italics.
The OECD average is 494, with a standard error of 0.5.

C. Suurtamm

Ontario: 514

International
average: 494

PISA 2012
Results in mathematics

PISA is an international
assessment for 15-year old
students

PISA sample item

SEAL'S SLEEP

A seal has to breathe even if it is asleep in the water. Martin observed a seal for one hour. At the start of his observation, the seal was at the surface and took a breath. It then dove to the bottom of the sea and started to sleep. From the bottom it slowly floated to the surface in 8 minutes and took a breath again. In three minutes it was back at the bottom of the sea again. Martin noticed that this whole process was a very regular one.

After one hour the seal was :

- ◆ At the Bottom
- ◆ On its way up
- ◆ Breathing
- ◆ On its way down

Focus of PISA
is on problem
solving

PISA results

- We are one of the top performing countries in PISA
- Of the top performing countries, we have one of the smallest gaps between those who perform well and those who are struggling – this says something about **equity in our country**

Guiding Principles for School Mathematics

- Access and Equity
- Curriculum
- Teaching and Learning
 - Effective teaching practices
- Tools and Technology
- Assessment
 - Effective classroom assessment
- Professionalism
 - Supporting teachers' professional learning



(Principles to Action, NCTM, 2014) http://www.nctm.org/uploadedFiles/Secondary_and_Focal_Points/Principles_to_Action/PtAExecutiveSummary.pdf

Guiding Principles for School Mathematics

- **Access and Equity.** An excellent mathematics program requires that all students have access to a high-quality mathematics curriculum, effective teaching and learning, high expectations, and the support and resources needed to maximize their learning potential.

EQUITY means that

all students have the right
to:

- ❖ Engage in rich mathematical activity
- ❖ Opportunities to develop their own strategies for solving problems
- ❖ Time to investigate mathematical ideas
- ❖ Develop conceptual understanding
- ❖ Feel valued as mathematical thinkers

Guiding Principles for School Mathematics

- **Curriculum.** An excellent mathematics program includes a curriculum that develops important mathematics along coherent learning progressions and develops connections among areas of mathematical study and between mathematics and the real world.

Ontario Mathematics Curriculum

- Built on theory and research about how children learn and ways to teach effectively
- Recognizes a continuum of learning
- Is aligned with curricula of other jurisdictions

Ontario Mathematics Curriculum

- Includes mathematics content and mathematical processes
- Promotes a variety of mathematical activity
- Helps to describe what mathematics teaching and learning should look like
- Should be the starting point for lesson design

Putting curriculum into action

What are the actions that students should be engaged in?

- Each person should have a whiteboard and marker.
- Divide up the strands in the Grade 9 curriculum among the participants at your table.
- Using the curriculum documents at the table (or an online version) choose an interesting verb from one of the expectations in that strand.
- Each person should write a verb on their white board – try to have different verbs at the table.
- Hold up your white board for others to see!

Actions that **students** should be doing

(as described in the Grade 9 Applied curriculum)

- Identify
- Compare
- Describe
- Explain
- Interpret
- Collect data
- Determine, through investigation
- Calculate
- Verify
- Create
- Represent
- Expand
- Simplify
- Sketch
- Predict
- Evaluate
- Solve
- Recognize
- Connect
- Gather
- Graph
- Distinguish
- Evaluate
- Pose problems

Alignment of curriculum & instruction

- You will be working pairs and have 20 minutes for this first part
- There are several curriculum expectations at your table. Divide them up so that each pair has a curriculum expectation(s)
- Each pair is to design a lesson that will address the assigned curriculum expectation – be sure to address both the nouns and VERBS in the expectation. Also, consider the mathematical processes that are also incorporated in your activity.
- Write out as much detail as possible about the instructional activity – include the task(s), materials that will be provided, what student solutions might be expected, etc.
- Be sure that both pair members understand the instructional activity as each member will be sharing it with others – maybe take a photo of the plan and/or activity so that you have a copy with you

Alignment of curriculum & instruction

(Part 2)

- Notice that there are 2 numbers to the left of your expectation (e.g. 13 – 24)
- These numbers relate to table numbers that you will soon move to (1 number for each member of the pair)
- Go to the table that you are assigned and find other people at that table who have the same expectation (there should be 2 expectations per table)
- Working with the people who have the same expectation, share the instructional activity that your pair developed.
- Compare the activities that were developed to address the expectation
- Be prepared to bring these ideas back to your school team

Grade 9 Busking

- Each individual at your table will be hearing from 4 of the 9 school teams to get a “glimpse” of the work that they did
- At your table there are cards – one for each of you
- You are to follow the schedule that is on the card starting promptly at 10:30 – you have 4 sessions of 15 minutes each including moving time
- Once you go to your first session, you will be moving with that group of people through the sessions
- return here to your table after your 4 busking sessions. Lunch will be served and over lunch, share with your own school team as each person may have seen different sessions

Now, break and be in your first busking room promptly at 10:30 -

Sharing your learning

- Take some time to go around the table and share the information that you gleaned by listening to the school teams
- What types of things did they do that intrigued you?
- What are some things your school is doing that are similar?
- Were there particular ways that they worked that sounded interesting?
- Is there something that you want to hear more about?

Lunch break & sharing

(11:50 – 1:00)

Use the time to

- share what you heard with your school team
- pick up expense forms from Kaye at the registration desk

We resume promptly at 1:00

What did teams
work on?

What were some
shifts in classroom
practices?

- Enhancing student engagement and developing a 'growth mindset'
- Reorganizing or re-sequencing of curriculum
- Blurring the lines between Applied and Academic pedagogies
- Assessment practices
- Continuum of learning across grades
- Integration of technology
- Design and implementation of rich tasks
- Focus on new approaches to developing algebraic thinking

Assessment practices

- Assessment is shifting due to instructional shifts
- Some teams have recognized that they have been paying greater attention to student thinking, and, thus, they have a better sense of students' understanding.
- The collection of artefacts and interviews with students has led to more **formative assessment** practices being used across the teams (e.g., Cases 1, 2, 3, & 6).
- Some schools have started to use **portfolio assessment** with their students (Cases 8).
- Several teams work with their students on the **co-construction** of rubrics, learning goals, and success criteria (e.g., Cases 5, 7, & 9)



UNIT 1: EXPLORING RELATIONSHIPS	
LEARNING GOALS	SUCCESS CRITERIA
<input type="checkbox"/> I can create a scatter plot.	
<input type="checkbox"/> I can explain the meaning of a point on a scatter plot.	
<input type="checkbox"/> I can describe the trend of a scatter plot.	
<input type="checkbox"/> I can describe the relationship between variables in a scatter plot.	
<input type="checkbox"/> I can draw lines or curves of best fit	
<input type="checkbox"/> I can find the value of a linear relation by interpolating or extrapolating from the graph	
<input type="checkbox"/> I can determine if a relation is LINEAR or NON-LINEAR	

Student: _____

GRADE 9 MATH PORTFOLIO

Unit 1	Item reflected on How I improved it	Signature
Unit 2	Item reflected on How I improved it	Signature
Unit 3	Item reflected on How I improved it	Signature
Unit 4	Item reflected on How I improved it	Signature
Unit 5	Item reflected on How I improved it	Signature
Unit 6	Item reflected on How I improved it	Signature
Unit 7	Item reflected on How I improved it	Signature
Unit 8	Item reflected on How I improved it	Signature

RUBRIC

Reflection & Correction	Level 4	Level 3	Level 2	Level 1
	Reflected and corrected 7 Units	Reflected and corrected 5 Units	Reflected and corrected 3 Units	Reflected and corrected 1 Unit

Continuum of learning across grades

Working with Grades 7 and 8 teachers, and/or to Grade 10 teachers, to better support learning across the grades and to:

- Develop a better understanding of the curriculum continuum
- Develop a better understanding of the students – discussing students and looking at data
- Develop a better understanding of teaching approaches and prior learning

Mathematical thinking tools

- Along with incorporating iPads, manipulatives, and other technologies . . .
- Several teams **used mini-white boards** with their students, and they commented that students seemed to engage with a problem more easily using these tools, as they could record their thinking on the white board in a non-permanent way.
 - The use of white boards seemed to make the students more willing to take risks and to practice recording their thinking.
 - In some cases, this use of non-permanent surfaces moved into using vertical non-permanent surfaces, so that students were up at white boards or windows, recording their thinking in a way that made it visible to others in the room, such that the classroom became a collaborative sharing space.

Integration of technology

- Finding resources, building teacher expertise, discussing implementation
- Use of iPads
 - In some schools - new initiative that all students have iPads
 - Finding apps that do more than practice skills
- Finding and using software – Desmos, Nearpod, etc.
- Use of videos as motivation – Dan Meyer, Jo Boaler
- Use of technology to document teacher learning – blogs, websites, twitter, etc.

Design and implementation of rich tasks

- Many 'problems of practice' identified the need to design and use rich tasks
- Teams worked on finding, adapting, designing, anticipating student responses, and implementing rich tasks.
 - Some teams sought to develop a resource bank of rich tasks (e.g., Cases 4 & 6).
 - Some used the artefacts or results from rich tasks to examine students' thinking (e.g., Cases 1, 3, & 7).
 - Teams reflected on the use of rich tasks in practice, and the different ways in which these tasks worked with different sets of students (e.g., Case 2).

Rich tasks

- Understanding the characteristics of a rich task
- Ways to implement tasks. Book studies to support teacher moves:
 - *Five Practices* (Smith & Stein, 2011)
 - *Connecting Mathematical Ideas* (Boaler & Humphreys, 2005)
- Classroom observations and debriefing sessions with helped to document this work

Some tasks took
nearly the whole
term:

Creating a mini-putt course

Each group worked on
developing one 'hole' of the
course

Students worked on this once a
week over an extended time

The work required particular
checkpoints, submission of
progress reports, etc.

The final course was shared with
the school as all students got to
'play the course'



Characteristics of Rich Tasks

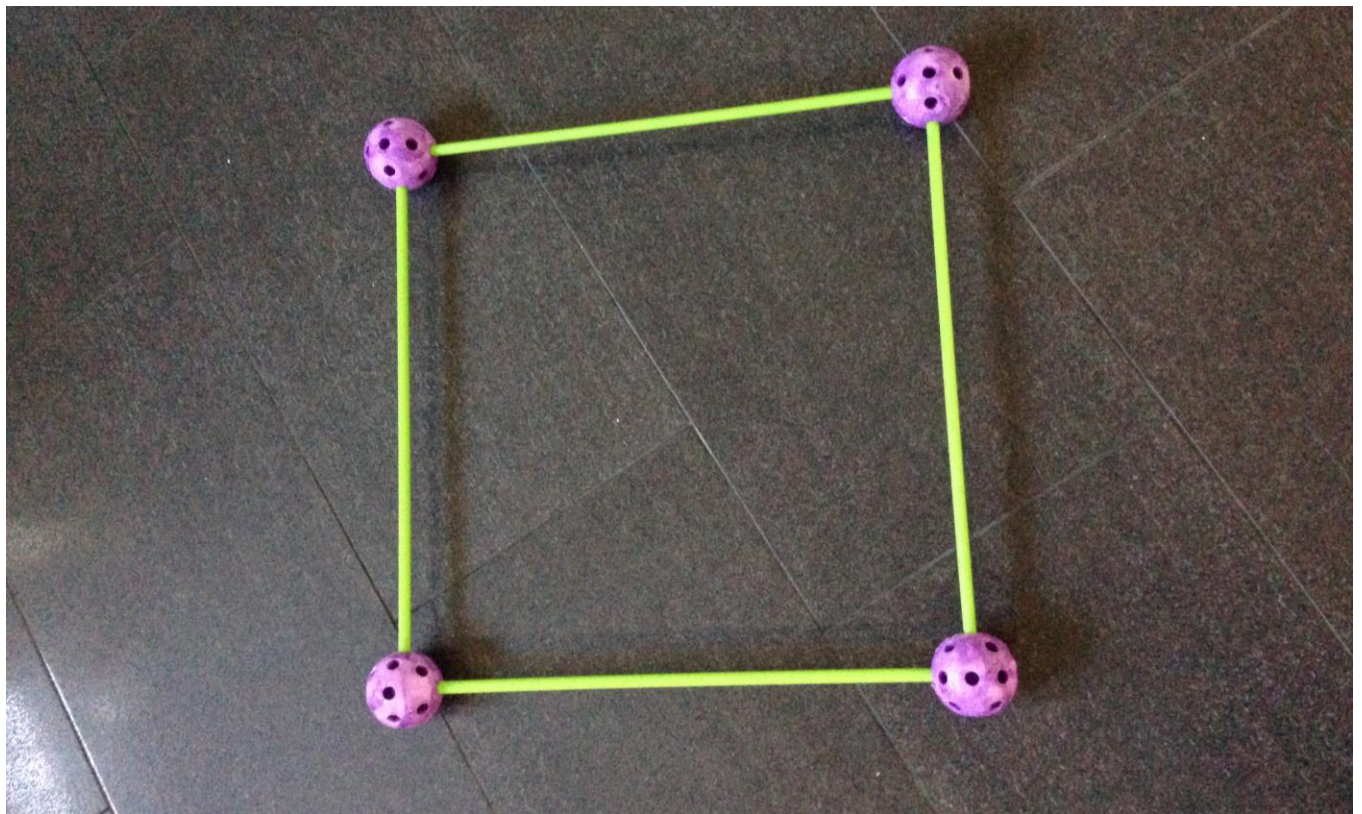
- Rich mathematical tasks provide varied opportunities for learning and encourage high quality student interaction (Bruce, 2007).
- They also provide multiple entry points so that all students can engage with the problem and experience success.
- Tasks that have high cognitive demand and multiple ways of solving problems provide opportunities for students' mathematical thinking and discussion (Boston, 2012; Smith & Stein, 2011).
- Scaffolding too early can reduce the cognitive demand and take away opportunities for students to explore and build confidence with solving problems in their own way.

Developing algebraic thinking

- Approaching this from a geometric and/or measurement standpoint – building structures
- Providing time to wrestle with algebraic ideas (the border problem)
- Allowing different expressions of algebraic thinking
- Considering vocabulary and patterning and algebra ideas from previous grades

Algebraic structures

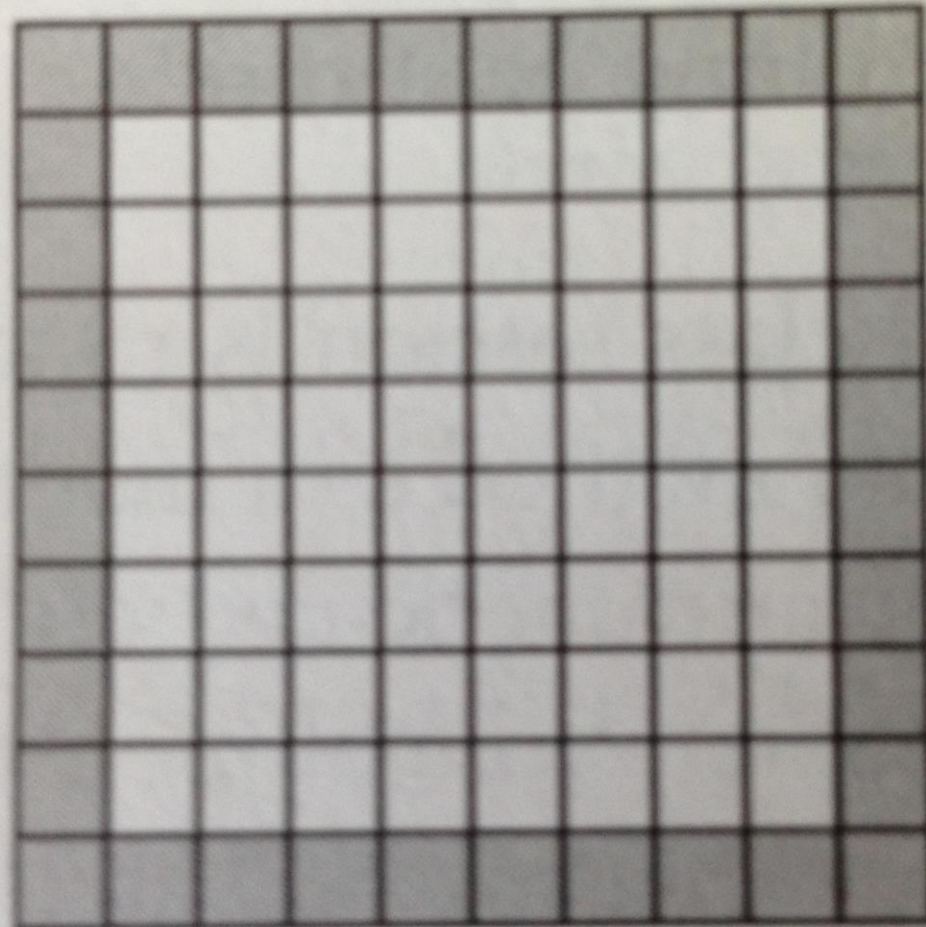
x^2



The Border Problem:

How many squares are shaded?

Developing a sense
of variable ,
simplifying
expressions,
equivalent
expressions



Figure

Workshops

- Providing administrative support – for the Admin person in each school team – stay in Ballroom
- For the rest of the team – you will be going to one of the following randomly selected workshops today (and another tomorrow)
 - Use of technology
 - Rearranging the curriculum
 - Design, implementation, and use of rich tasks and projects
 - Ways to engage students and make thinking visible
 - Building a continuum of learning across grades
 - Development of learning goals, success criteria, and other assessment strategies

Be ready to report back to your team and table mates about the workshop

Tickets and rooms

Ticket Number	Room
1	London A
2	London B
3	Balmoral A
4	Balmoral B
5	Kensington 1 – bring iPad
6	Kensington 2
Administrator (VP, Principal, or designate)	Remain in ballroom

One school team should take the odd numbers, the other the even – we will switch tomorrow

Workshops run from 1:30 until 2:45
Break is from 2:45 – 3:00
Return here promptly at 3:00 – ready to share

Break until 3 pm

Then sharing your workshops

Workshop sharing

Share your workshop experience with your school team members

- What did you experience?
- What ideas might be useful to your school, classroom, colleagues, students?

Enjoy your evening

Breakfast at 8 am tomorrow

We begin promptly at 9 am